CLAIMS

1. A burner apparatus comprising an inner tube defining a second channel and an outer tube defining a first channel surrounding the inner tube, oxygen-containing gas supplying means for supplying oxygen-containing gas to the first channel and the second channel, and gas supplying means for supplying fuel gas to the first channel and the second channel, either the first channel or the second channel being used as a main combustion channel and the other being used as a pilot combustion channel, the main combustion channel and the pilot combustion channel receiving the supply of fuel gas for combusting it;

wherein said gas supplying means includes a plurality of fluid distributors arranged in dispersion in a peripheral direction of the main combustion channel and the pilot combustion channel, each fluid distributor including a first supply opening for supplying the fuel gas into the main combustion channel, a supply line for supplying the fuel gas present inside the gas channel to the first supply opening, and distributing means incorporated in the supply line for distributing the fuel gas into the pilot combustion channel so that the distribution ratio of the fuel gas to be supplied to the first supply opening is increased in response to increase in a total supply amount of the fuel gas from the gas channel and conversely the distribution ratio of the fuel gas to be supplied to the first supply opening is decreased in response to decrease in the total supply amount.

2. The burner apparatus according to claim 1, wherein the first channel is used as the main combustion channel and the second channel is used as the pilot combustion channel.

3. The burner apparatus according to claim 1, wherein the distributing means includes, in the supply line, a second supply opening

for discharging the fuel gas into the pilot combustion channel in a direction normal to the flowing direction of the oxygen-containing gas inside the pilot combustion channel and a communication line for receiving the fuel gas discharged from the second supply opening and guiding the gas into the first supply opening, and at a position opposed to the second supply opening and spaced apart by a predetermined distance in the discharging direction of the second supply opening, there is provided a receiving opening of the communication line as to be open toward the second supply opening.

4. The burner apparatus according to claim 3, wherein at least one of the first supply opening and the second supply opening comprises a slit-like opening having a longitudinal direction along the peripheral direction of the main combustion channel and the pilot combustion channel.

5. The burner apparatus according to claim 1, wherein said fluid distributor includes a plurality of said first supply openings distributed in the main combustion channel in a direction away from the pilot combustion channel.

6. The burner apparatus according to claim 5, wherein the supply line is provided in correspondence to each of the plurality of first supply openings.

7. The burner apparatus according to claim 5, wherein the fluid distributor is constructed such that the supply lines corresponding to the plurality of first supply openings are formed in a plate-like member disposed within the main combustion channel with its plate surface oriented along the oxygen-containing gas flow direction.

8. The burner apparatus according to claim 7, wherein the plate-like

members of the plurality of fluid distributors are disposed with each plate surface thereof oriented along the spiral direction of the main combustion channel so as to act as a fin of a swirler for providing a swirling force to the supplied oxygen-containing gas.

9. The burner apparatus according to claim 1, wherein at a portion of the main combustion channel more downstream than the first supply openings in the oxygen-containing gas flow direction, there is provided a swirler for providing a swirling force to the fuel-gas mixture of the oxygen-containing gas and the fuel gas in the spiral direction of the main combustion channel.

10. The burner apparatus according to claim 1, wherein the first supply opening is disposed, in the main combustion channel, with an orientation for discharging the fuel gas toward more upstream side of the flow direction of the oxygen-containing gas than the direction normal to the flow direction of the oxygen-containing gas.

11. The burner apparatus according to claim 10, wherein the first supply opening is disposed, in the main combustion channel, with an orientation for discharging the fuel gas in a direction opposing to the oxygen-containing gas flow direction.

12. The burner apparatus according to claim 1, further comprising a mixing promoting member against which the fuel gas discharged from the first supply opening into the main combustion channel is collided to be diffused in the main combustion channel.

13. The burner apparatus according to claim 12, wherein the mixing promoting member comprises a ring-like member disposed along the

peripheral direction of the main combustion channel and having a plate face along the discharging direction of the fuel gas of the plurality of first supply openings distributed along the peripheral direction.

14. The burner apparatus according to claim 3, wherein there is provided a second shielding member for adjusting an inflow amount of the oxygen-containing gas, for the second gas supply area extending from the upstream side of the second supply opening in the flow direction of the oxygen-containing gas via the second supply opening of the pilot combustion channel to the receiving opening.

15. The burner apparatus according to claim 14, wherein the second shielding member comprises a member disposed across at least a portion of the second gas supply area upstream in the flow direction of the oxygen-containing gas.

16. The burner apparatus according to claim 14, wherein the second shielding member comprises a tubular member which surrounds a portion of the second gas supply area.

17. The burner apparatus according to claim 14, wherein the second shielding member defines an opening for adjusting the inflow condition of the oxygen-containing gas to the second gas supply area.

18. The burner apparatus according to claim 5, wherein discharging resistance of the fuel gas from each said first supply opening due to passage of the oxygen-containing gas is set so as to increase as being distant from the pilot combustion channel.

19. The burner apparatus according to claim 18, wherein the setting of

the discharging resistance of the fuel gas is done such that a discharging angle for the fuel gas at each said first supply opening toward the upstream side in the flow direction of the oxygen-containing gas in the main combustion channel is decreased as being distant from the pilot combustion channel.

20. The burner apparatus according to claim 18, wherein the setting of the discharging resistance of the fuel gas is done such that the discharging direction of the fuel gas from the plurality of first supply openings is set to be more upstream than the direction normal to the flow direction of the oxygen-containing gas in the main combustion channel and also that the opening area of each said first supply opening is increased as being distant from the pilot combustion channel.

21. The burner apparatus according to claim 1, wherein the first supply openings are configured to supply the fuel gas into the first channel along the direction of the main combustion channel distant from the pilot combustion channel; and

a first shielding member is provided for preventing inflow of the oxygen-containing gas from the upstream side along the flow direction of the oxygen-containing gas in the first channel, for a first gas supply area formed by the fuel gas supplied from the first gas supply openings inside the main combustion channel.

22. The burner apparatus according to claim 21, wherein a ratio (c/e) between a distance (c) between the opening center of the first supply opening and the first shielding member defined along the oxygen-containing gas flow direction of the main combustion channel and an opening width (e) of the first supply opening defined in said direction is set to be greater than or equal to 0.5 and smaller than or equal to 1.5.

23. The burner apparatus according to claim 21, wherein the first shielding member comprises a member which extends in the direction where the main combustion channel extends away from the pilot combustion channel, one first end of the first shielding member on the side adjacent the first supply opening has a width (a) along the peripheral direction of the main combustion channel, the other second end has a width (b) along the peripheral direction, the first supply opening has a width (d) along the peripheral direction; and

a ratio (a/d) between said width (a) and said width (d) is greater than or equal to 1 and smaller than or equal to 3, and a ratio (b/d) between said width (b) and said width (d) is greater than or equal to 0 and smaller than or equal to 2.

24. The burner apparatus according to claim 21, wherein a hollow tubular fuel supplying member having a porous wall portion is attached to the first supply opening.

25. The burner apparatus according to claim 1, wherein said fluid distributor comprises a distributing member which is provided in the main combustion channel and defines the first supply opening in its outer surface, and which forms therein an oxygen-containing gas inlet duct for guiding the oxygen-containing gas supplied from the supply line and the oxygen-containing gas supplying means to the pilot combustion channel; and

said distributing means includes, in said distributing member, a second supply opening for discharging the fuel gas into the oxygen-containing gas inlet duct in a direction intersecting the flow direction of the oxygen-containing gas inside the oxygen-containing gas inlet duct, a communication line for receiving the fuel gas discharged from the second supply opening and guiding it to the first supply opening, and a receiving

opening for the communication line disposed at a position opposing to the second supply opening with a predetermined distance relative thereto in the discharging direction, with the receiving opening being open to the second supply opening.

26. The burner apparatus according to claim 25, wherein the distributing member comprises a plate-like member disposed within the main combustion channel with a plate face thereof being oriented along the flow direction of the oxygen-containing gas in the main combustion channel.

27. A burner apparatus comprising an inner tube defining a second channel and an outer tube defining a first channel surrounding the inner tube, oxygen-containing gas supplying means for supplying oxygen-containing gas to the first channel and the second channel, and gas supplying means for supplying fuel gas to the first channel and the second channel, either the first channel or the second channel being used as a main combustion channel and the other being used as a pilot combustion channel, the main combustion channel and the pilot combustion channel receiving the supply of fuel gas for combusting it, the apparatus comprising:

a common channel formed at one end of the inner tube and the outer tube for supplying the oxygen-containing gas to the main combustion channel and the pilot combustion channel;

a common supply opening for discharging the fuel gas of the gas channel in said common channel from the upstream side in the flow direction of the oxygen-containing gas of the pilot combustion channel to the upstream side in the flow direction of the oxygen-containing gas of the main combustion channel; and

a common shielding member for adjusting the inflow amount of the oxygen-containing gas, for a common gas supply area which extends in a discharging direction of the fuel gas from the upstream side in the oxygen-

containing gas flow direction of the common supply opening and from this common supply opening to the common channel.

28. The burner apparatus according to claim 27, wherein said first channel is used as the main combustion channel and said second channel is used as the pilot combustion channel.

29. A burner apparatus comprising an inner tube defining a second channel and an outer tube defining a first channel surrounding the inner tube, oxygen-containing gas supplying means for supplying oxygen-containing gas to the first channel and the second channel, and gas supplying means for supplying fuel gas to the first channel and the second channel, either the first channel or the second channel being used as a main combustion channel and the other being used as a pilot combustion channel, the main combustion channel and the pilot combustion channel receiving the supply of fuel gas for combusting it;

wherein a first supply opening for supplying the fuel gas into the main combustion channel is disposed, in the main combustion channel, with an orientation for discharging the fuel gas toward more upstream side of the flow direction of the oxygen-containing gas than the direction normal to the flow direction of the oxygen-containing gas.

30. The burner apparatus according to claim 29, wherein the first supply opening is disposed, in the main combustion channel, with an orientation for discharging the fuel gas in a direction opposing to the oxygen-containing gas flow direction.

31. A burner apparatus comprising an inner tube defining a second channel and an outer tube defining a first channel surrounding the inner tube, oxygen-containing gas supplying means for supplying oxygen-

containing gas to the first channel and the second channel, and gas supplying means for supplying fuel gas to the first channel and the second channel, either the first channel or the second channel being used as a main combustion channel and the other being used as a pilot combustion channel, the main combustion channel and the pilot combustion channel receiving the supply of fuel gas for combusting it;

wherein the main combustion channel includes a mixing promoting member against which the fuel gas discharged from the first supply opening into the main combustion channel is collided to be diffused in the main combustion channel or the pilot combustion channel includes a mixing promoting member against which the fuel gas discharged from the second supply opening for supplying the fuel gas into the pilot combustion channel is collided to be diffused in the pilot combustion channel.

32. The burner apparatus according to claim 31, wherein the mixing promoting member comprises a ring-like member disposed along the peripheral direction of the main combustion channel or the pilot combustion channel and having a plate face along the discharging direction of the fuel gas of the plurality of first supply openings or second supply openings distributed along the peripheral direction.

33. A burner apparatus comprising an inner tube defining a second channel and an outer tube defining a first channel surrounding the inner tube, oxygen-containing gas supplying means for supplying oxygen-containing gas to the first channel and the second channel, and gas supplying means for supplying fuel gas to the first channel and the second channel, either the first channel or the second channel being used as a main combustion channel and the other being used as a pilot combustion channel, the main combustion channel and the pilot combustion channel receiving the supply of fuel gas for combusting it;

wherein a plurality of said first supply openings for supplying the fuel gas into the main combustion channel are distributed in the main combustion channel in a direction away from the pilot combustion channel; and

discharging resistance of the fuel gas from each said first supply opening due to passage of the oxygen-containing gas is set so as to increase as being distant from the pilot combustion channel.

34. The burner apparatus according to claim 33, wherein the setting of the discharging resistance of the fuel gas is done such that a discharging angle for the fuel gas at each said first supply opening toward the upstream side in the flow direction of the oxygen-containing gas in the main combustion channel is decreased as being distant from the pilot combustion channel.

35. The burner apparatus according to claim 33, wherein the setting of the discharging resistance of the fuel gas is done such that the discharging direction of the fuel gas from the plurality of first supply openings is set to be more upstream than the direction normal to the flow direction of the oxygen-containing gas in the main combustion channel and also that the opening area of each said first supply opening is increased as being distant from the pilot combustion channel.

36. A burner apparatus comprising an inner tube defining a second channel and an outer tube defining a first channel surrounding the inner tube, oxygen-containing gas supplying means for supplying oxygen-containing gas to the first channel and the second channel, and gas supplying means for supplying fuel gas to the first channel and the second channel, either the first channel or the second channel being used as a main combustion channel and the other being used as a pilot combustion channel,

the main combustion channel and the pilot combustion channel receiving the supply of fuel gas for combusting it;

wherein a first supply opening for supplying the fuel gas into the main combustion channel supplies to the fuel gas into the first channel along the direction of the main combustion channel distant from the pilot combustion channel; and

a first shielding member is provided for preventing inflow of the oxygen-containing gas from the upstream side along the flow direction of the oxygen-containing gas in the first channel, for a first gas supply area formed by the fuel gas supplied from the first gas supply openings inside the main combustion channel.

37. The burner apparatus according to any one of claims 29-36, wherein the first channel is used as the main combustion channel and the second channel is used as the pilot combustion channel.

38. The burner apparatus according to any one of claims 29-36, wherein said gas supplying means includes a plurality of fluid distributors arranged in dispersion in a peripheral direction of the main combustion channel and the pilot combustion channel, each fluid distributor including a first supply opening for supplying the fuel gas into the main combustion channel, a supply line for supplying the fuel gas present inside the gas channel to the first supply opening, and distributing means incorporated in the supply line for distributing the fuel gas into the pilot combustion channel so that the distribution ratio of the fuel gas to be supplied to the first supply opening is increased in response to increase in a total supply amount of the fuel gas from the gas channel and conversely the distribution ratio of the fuel gas to be supplied to the first supply opening is decreased in response to decrease in the total supply amount.

39. A gas turbine engine including the burner apparatus according to any one of claims 1-36 for rotating a turbine by kinetic energy of combustion exhaust gas exhausted from the burner apparatus.

40. A co-generation system including the gas turbine engine according to claim 39 and a heat recovery device for recovering heat from exhaust gas exhausted from the gas turbine engine in association with rotation of the turbine.

41. A fluid distributor disposed across three channels including first and second channels through which a first fluid is caused to flow and a fluid channel through which a second fluid is caused to flow, so that the distributor distributes the fuel gas inside the fluid channel between the first channel and the second channel;

wherein the distributor includes a first supply opening for supplying the second fluid into the first channel, a supply line for supplying the second fluid present inside the fluid channel to the first supply opening, and distributing means incorporated in the supply line for distributing the second fluid into the second channel so that the distribution ratio of the second fluid to be supplied to the first supply opening is increased in response to increase in a total supply amount of the second fluid from the fluid channel and conversely the distribution ratio of the second fluid to be supplied to the first supply opening is decreased in response to decrease in the total supply amount.

42. The fluid distributor according to claim 41, wherein the distributing means includes, in the supply line, a second supply opening for discharging the second fluid into the second channel in a direction normal to the flowing direction of the first fluid inside the second channel and a communication line for receiving the second fluid discharged from the

second supply opening and guiding the fluid into the first supply opening; and

at a position opposed to the second supply opening and spaced apart by a predetermined distance in the discharging direction of the second supply opening, there is provided a receiving opening of the communication line which opening as to be open toward the second supply opening.

43. The fluid distributor according to claim 43, wherein said first channel and said second channel are disposed in juxtaposition, and a plurality of said first supply openings are distributed in the first channel in a direction away from the second channel.

44. The fluid distributor according to claim 43, wherein the supply line is provided in correspondence to each of the plurality of first supply openings.

45. The fluid distributor according to claim 43, wherein the fluid distributor is constructed such that the supply lines corresponding to the plurality of first supply openings are formed in a plate-like member disposed within the first channel with its plate surface oriented along the flow direction of the first fluid.

46. A burner apparatus comprising oxygen-containing gas supplying means for supplying oxygen-containing gas as the first fluid to the first channel and the second channel, and gas supplying means for supplying fuel gas as the second fluid to the first channel and the second channel, the first channel being used as a main combustion channel and the second channel being used as a pilot combustion channel, the main combustion channel and the pilot combustion channel receiving the supply of fuel gas for combusting it, the apparatus comprising:

wherein said gas supplying means includes the fluid distributor according to any one of claims 41-45 as a fluid distributor for supplying the fuel gas present in the gas channel in distribution to the first channel and the second channel.

47. A gas turbine engine including the burner apparatus according to claim 46 for rotating a turbine by kinetic energy of combustion exhaust gas exhausted from the burner apparatus.

48. A co-generation system including the gas turbine engine according to claim 47 and a heat recovery device for recovering heat from exhaust gas exhausted from the gas turbine engine in association with rotation of the turbine.